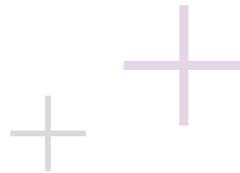
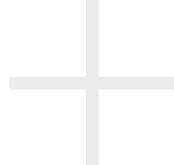


Zühlke Sustainable IT

What does it mean? What is necessary?

Stefan Novoszel | 08.11.2023 | Sustainability Circle

Facts & figures



» Austria	» Serbia
Vienna	Belgrade
» Bulgaria	» Singapore
Sofia	Singapore
» Germany	» Switzerland
Frankfurt	Bern
Hamburg	Zurich
Hannover	
Munich	
Stuttgart	
» United Kingdom	
Edinburgh	
London	
Manchester	
» Hong Kong	
Hong Kong	
» Portugal	» Vietnam
Porto	Ho Chi Minh City



Founded in 1968



17 offices in 10 countries



1,900 employees worldwide



The Zühlke Group is owned by partners



Certifications:
ISO 9001,
ISO 13485,
ISO 27001



We put data at the heart of everything we do



Sustainability focus: climate action and health improvement

» Zühlke – empowering ideas.

We believe that innovation and technology
are a positive force of change for
business and society.

We support our clients to envision and
create a sustainable future.



Our Sustainability Roadmap

Positive project impact

By 2027, **all projects have a basic positive impact** and 25% of revenue is from substantial positive impact projects.

From 2023 to 2027, Zühlke helps clients to avoid >1 million tons of CO₂.

From 2023 to 2027, Zühlke helps clients to reach >1 million people with significant health benefits.

* Our method PIA (Positive Impact Assessment) is used to evaluate project impact.

Sustainable way of working

By 2030, Zühlke has reduced Scope 1+2 emissions by 90% and has neutralised the remaining 10% to reach net-zero direct emissions. Scope 3 emissions have been reduced by 42%, also by 2030.

By 2040, Zühlke has reduced Scope 1+2+3 emissions by 90% and has neutralised the remaining 10% to reach net-zero across the full value chain.

* The baseline for comparison are the 2021 emissions. The goals are aligned with the Net-Zero standard of the Science Based Target initiative (SBTi).

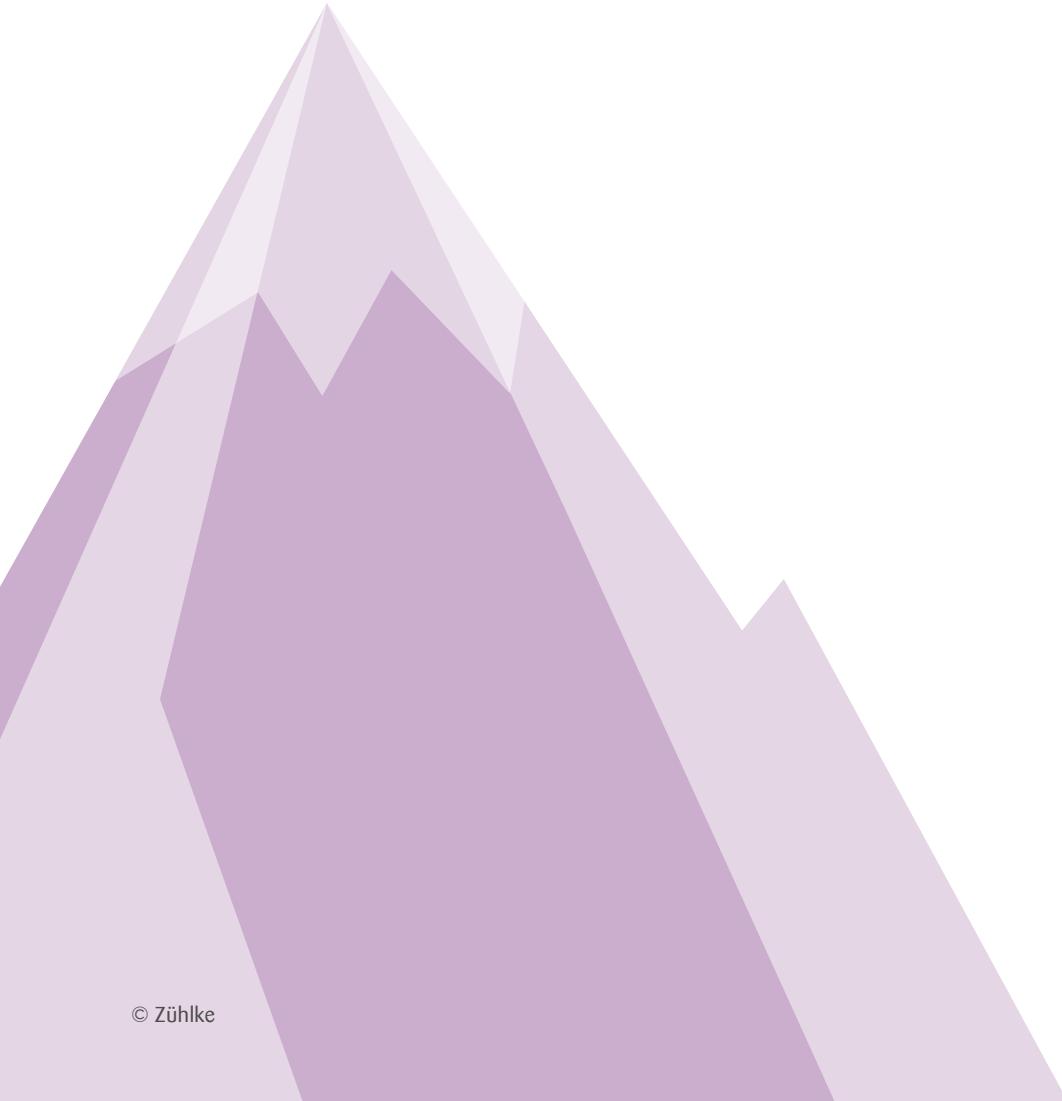
Community engagement

Continuously, Zühlke contributes to positive change in society through know-how sharing, networking, donations, and pro bono work.

* Specific focus, activities and funding are decided by the operating companies.

Impact levels

Summarising the impact as a **potential rating** (before/during the project) or **actual rating** (after the project)



Exceptional positive impact

The project's impact is worthy of an award (in addition to the criteria below). The contribution of Zühlke is substantial, compared to contributions by our client and other partners.



Substantial positive impact

The project has a key objective that is directly linked to an environmental or social benefit (in addition to other criteria below). It contributes to the 17 UN Sustainability Development Goals.



Positive impact

The project has (co-)benefits for society and/or the environment, beyond a purely commercial business case. Any negative impacts are mitigated. The project has an Impact Statement.



Primarily economic impact

The project has economic benefits, but the above criteria for positive impact are not met, e.g. due to slightly negative, missing positive, or generally unclear environmental and social impacts.



Negative impact

Project has or would likely have on balance a significant negative impact.

Our Expertise



Strategy & Business Innovation

We create digital strategies and breakthrough innovations that deliver long-term value.

Device & Systems Engineering

We are trusted by our clients, from design, through to production and launch of innovative devices and systems.

Digital Solutions & Application Services

We develop new digital products and turn-key applications with added value.

Data & AI Solutions

We believe in delivering change to humans and the planet through the ethical use of data & AI.

Who I am

Sustainable SW Solutions

Starting of the group-wide initiative | 2021

Beliefs

Technology can be a game changer. By helping us to make the most sustainable decisions and implement things more efficiently. But we need good political frameworks!

Contributions

Using my know-how and experience to support my customers, sustainability initiatives and to write articles/books.

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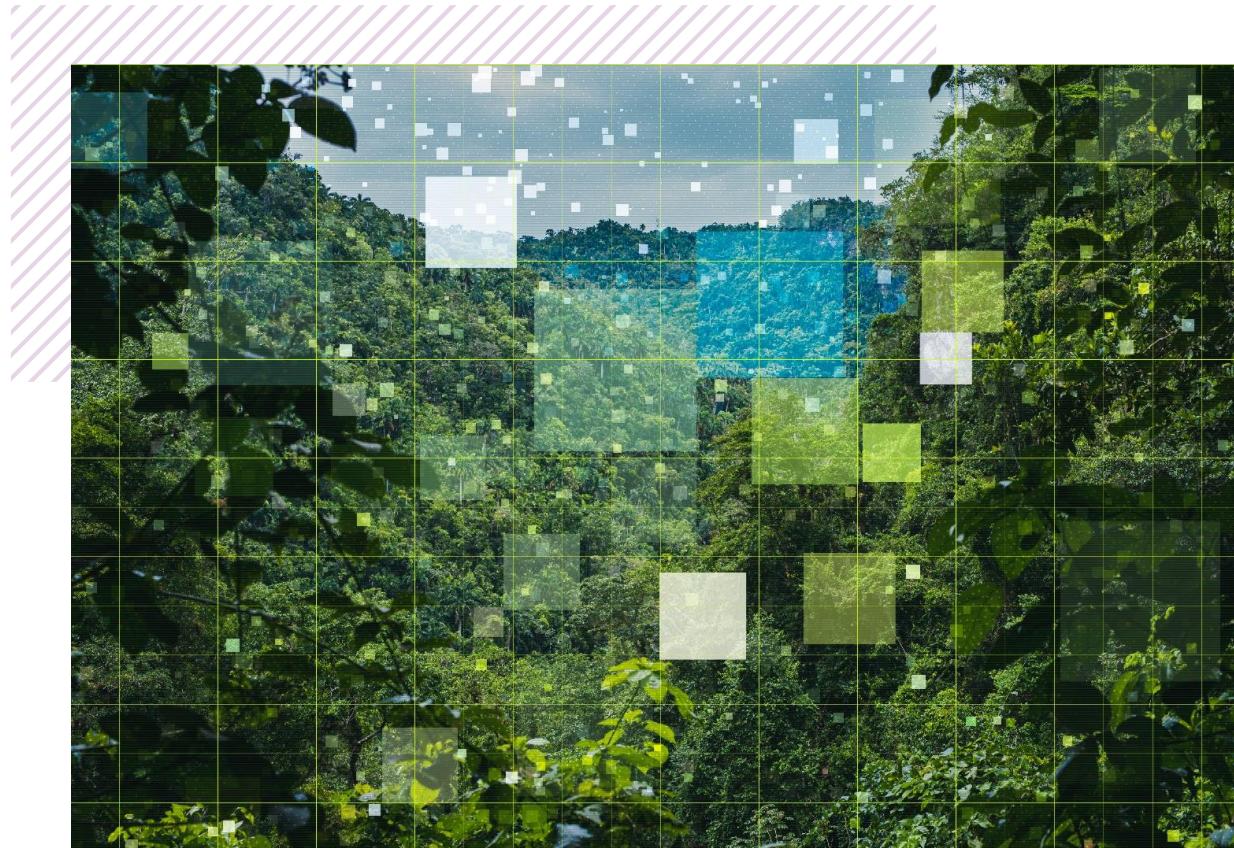
M +43664 3906248



Stefan Novoszel

Group Head for
Sustainable SW Solutions



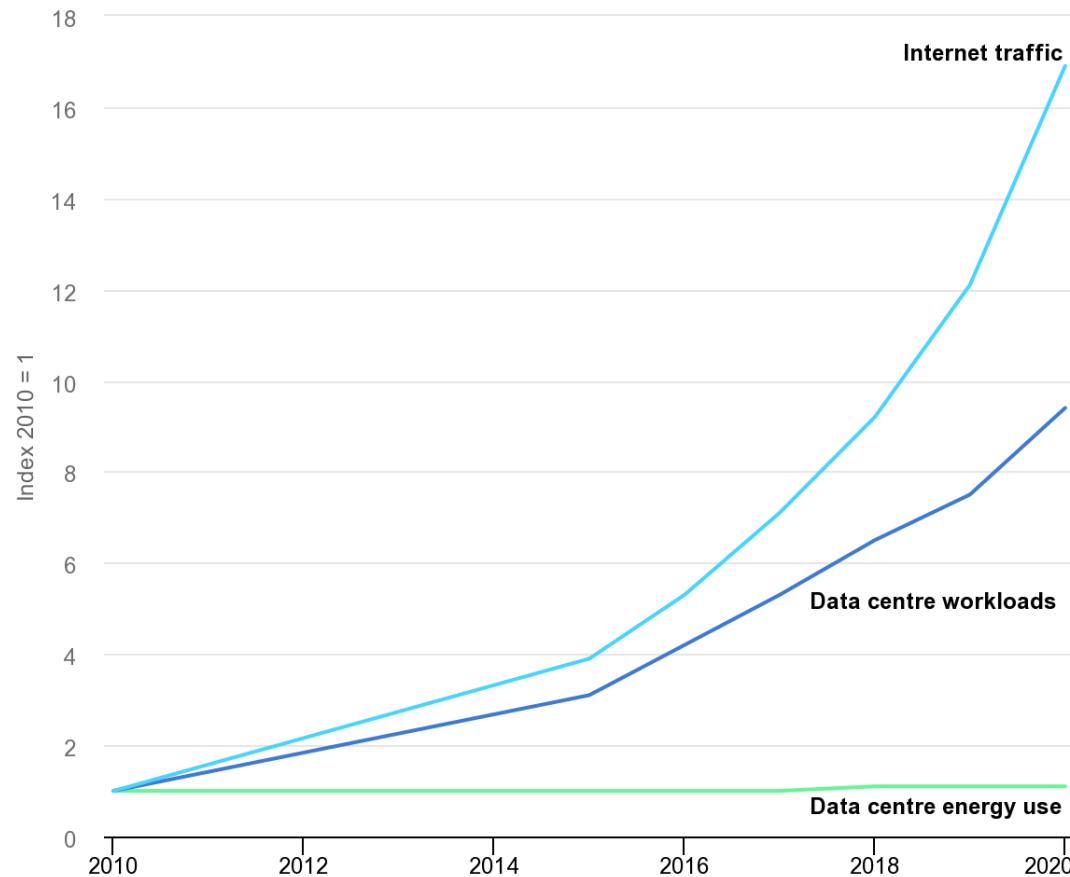


Environmental

Green-IT Resource sensitivity

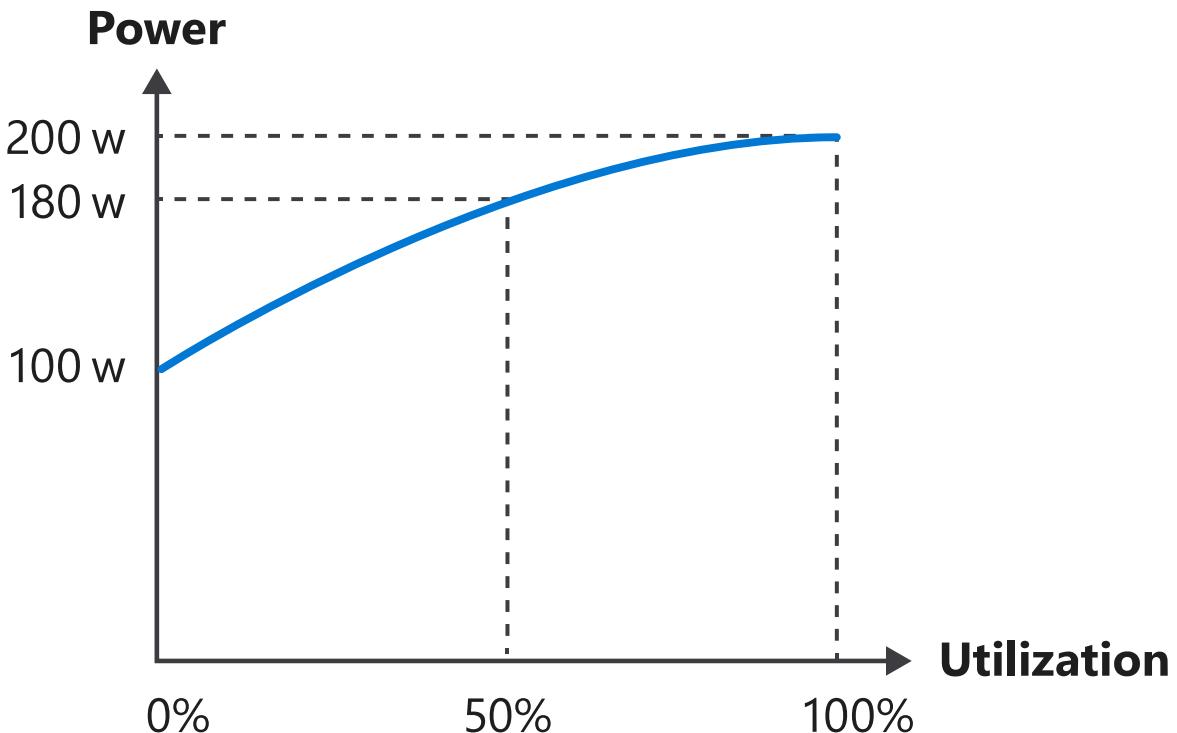
Statistics of the International Energy Agency

(numbers from 2020)



- **Global electricity demand**
 - Data Centers $\approx 1\%$
 - Data Networks $\approx 1,4\%$ (tendency to increase)
- **Drivers of energy demand**
 - Video Streaming
 - Machine learning (Training of Models)
 - Blockchain infrastructure (mainly Bitcoin)
 - 5G
 - Virtual Reality

Consequences of inefficiency



Source: <https://docs.microsoft.com/en-us/learn/modules/sustainable-software-engineering-overview/7-energy-proportionality>

Average Active Volume Server **Utilization rates** of internal Data Centers will be at 15% and for Hyperscalers at 50% (now 65%) by 2020.
US Data Center Energy Usage Report - June 2016

It is estimated that **up to 30** percent of the country's 12 million servers are actually "**comatose**" – abandoned by application owners and users but still racked and running, wasting energy and placing ongoing demands on data center facility power and capacity.
Estimation by the UptimeInstitute

Saving resources with High Performance Computing



More resource-aware cloud solution reduces costs and emissions

Initial situation & challenge

The project started with a pilot client in the actuarial field. VALOG wanted to give them a tool so that their clients could make faster calculations in the area of social capital reserves. This is a type of provision that companies are obliged to make if they pay out promised money to their employees in the future. This includes, for example, anniversary bonuses or severance payments. Various parameters have to be taken into account for the calculation, which makes it complex and costly and time-consuming. The newly crafted software has made this process much easier.

Approach & Solution

Zühlke and Valog developed a novel algorithm that takes these complex constellations into account and makes the entire process chain much more easy and user-friendly. From data acquisition and comparison with previous years to the final calculation.

The actuaries simply upload the desired data as an Excel file in the app and can also export the result as Excel, which simplifies follow-up processes.

Impact & benefit

In addition to better efficiency, this brings lower power consumption - meaning more sustainability - and even more speed through parallelisation. Depending on the amount of calculations, the resources can be increased to up to 150 servers.

This happens automatically and in real time.

Green IT for the DB Group



Building a community and identifying measures to reduce IT-related emissions

Initial situation & challenge

As part of its green transformation, German railway (DB Group) is not only making its products and services more sustainable, but also its way of working. This includes IT systems in particular, as IT is responsible for around 10% of electricity consumption and around 5% of CO2 emissions in Germany. How can IT be made more sustainable? To answer this question, DB IT asked Zühlke for support. A joint project aimed to determine the potential of green IT, derive concrete measures and build a green IT community for efficient implementation.

Approach & Solution

Zühlke conducted workshops together with employees from the IT departments of DB to formulate the goals of green IT and to identify measures that would have the greatest positive impact as quickly as possible. The Zühlke experts then used their knowledge and experience from Green IT projects with other companies and sectors to draw up a roadmap with concrete initiatives and measurable results.

Impact & benefit

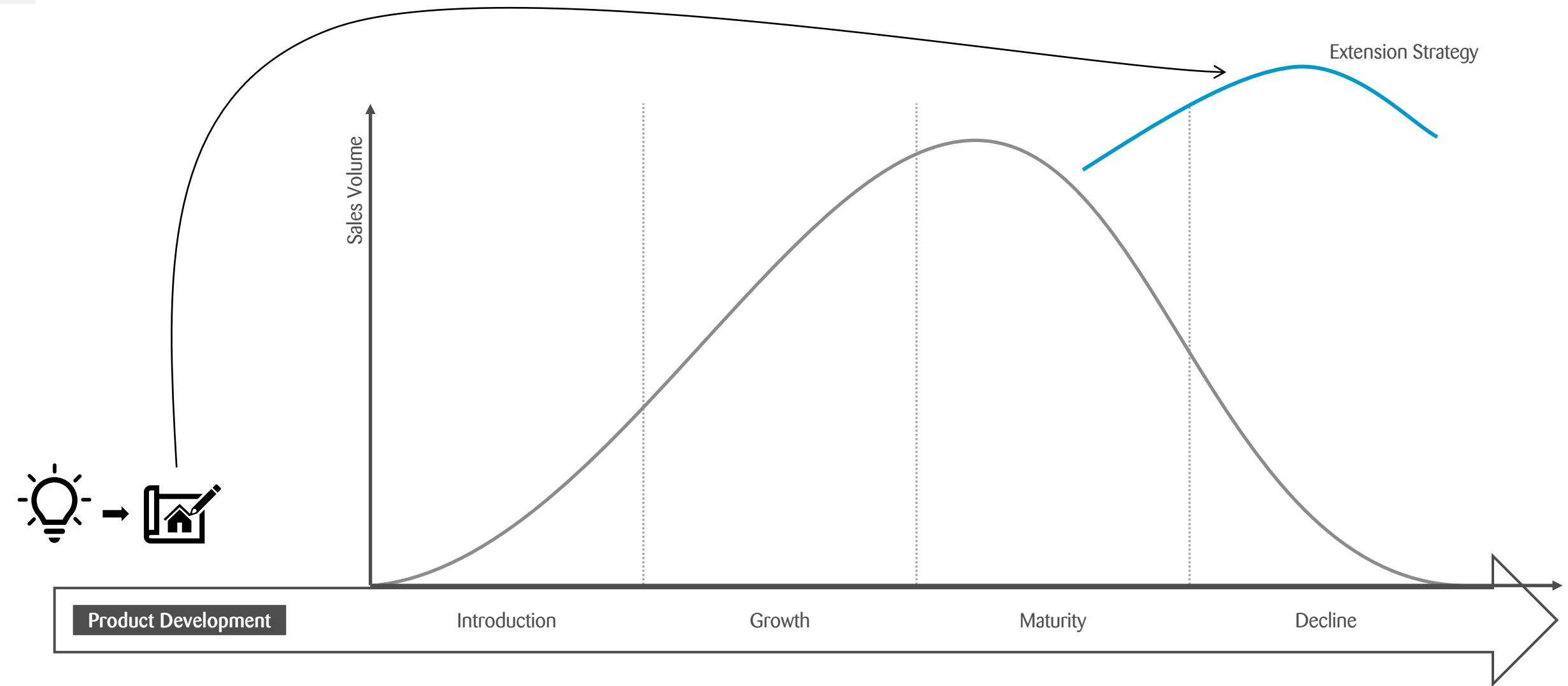
Within 8 weeks, the project team of DB and Zühlke succeeded in strengthening the IT community and defining seven concrete measures for sustainable IT. DB combined the ideas and enthusiasm of its own employees with the Green IT expertise of Zühlke in order to achieve its own sustainability goals more quickly. Based on the positive results of the project, the CIO Board gave the green light for the further implementation of Green IT in order to implement the identified measures and roll them out across the corporation.



Evolutionary

Operability
Adaptability

Make Innovation possible



Federated Learning for Privacy Preserving AI

AO
Innovation Translation
Center



**Enabling medical research while
protecting highly sensitive
personal data**

Initial situation & challenge

The goal of the AO Foundation is to enable best-in-class treatments within surgeries. AI offers a lot of opportunities, but there is one major challenge: to perform well, algorithms require a lot of data, which in the case of health data are often collected in silos (e.g. in different clinics) and furthermore often cannot be shared across clinics due to privacy reasons. Therefore, the AO Foundation teamed up with Zühlke to explore how Federated Learning could provide a solution to this challenge.

Approach & Solution

First, the vision of a Federated Learning platform, its business case as well as the scope of a first prototype are shaped. Semantic segmentation of spine computed tomographies (CTs) was chosen as the first use case, due to its importance in surgery planning. Stakeholders at partner clinics were involved to establish the foundation for future implementation across clinics. In only three months, Zühlke developed a Federated Learning platform concept as well as a fully functional federated spine segmentation proof of concept based on a proprietary dataset.

Impact & benefit

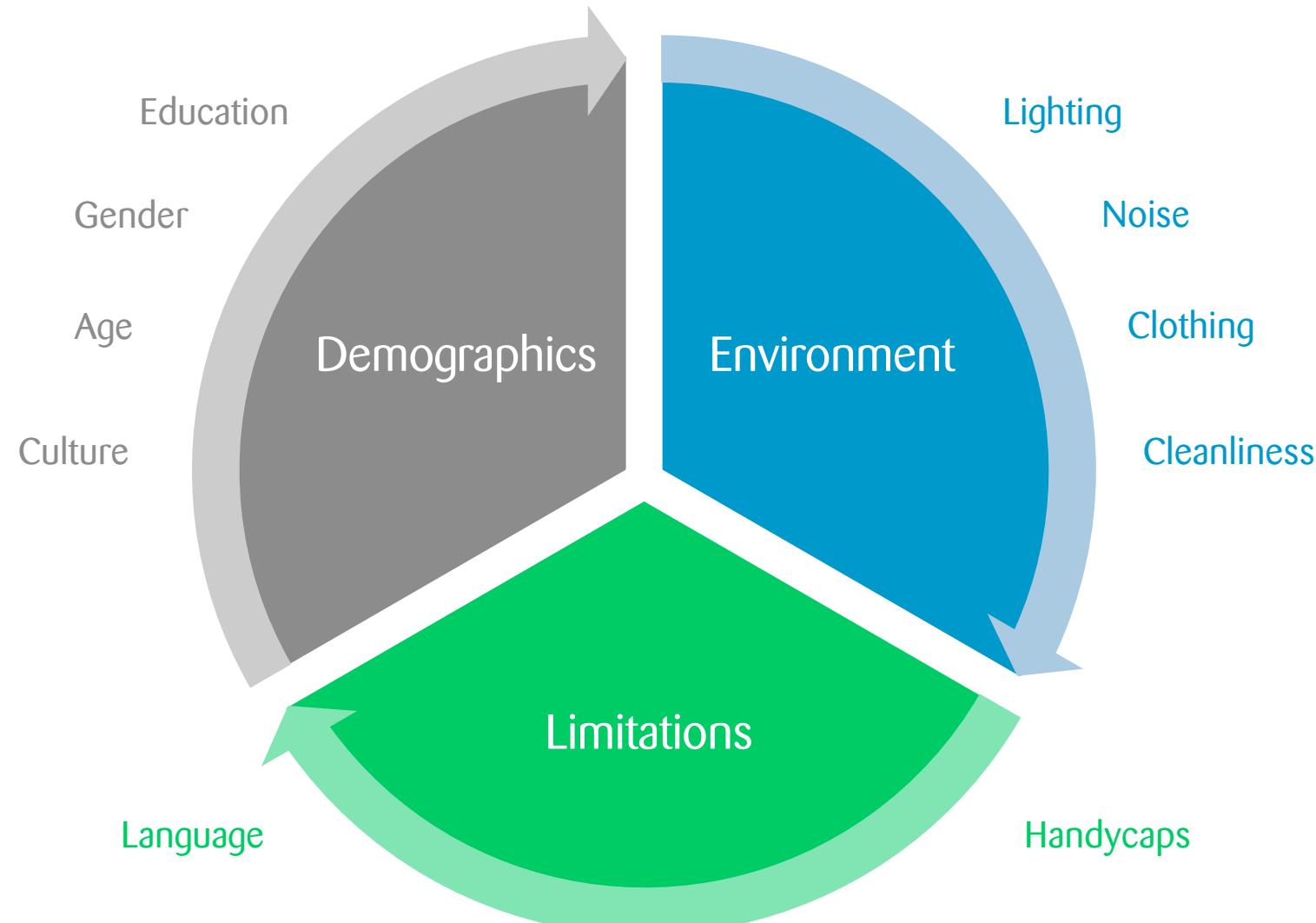
The proof of concept is based on a special purpose algorithm to train the semantic segmentation model in a federated, decentralized manner, without the need to share private data across clinics. In addition to the technical solution, a platform concept covering organizational topics related to partner clinics has been developed. After the evaluation of the model's performance, the AO Foundation and Zühlke presented the results at the International Health Summit 2020.



Accessibility

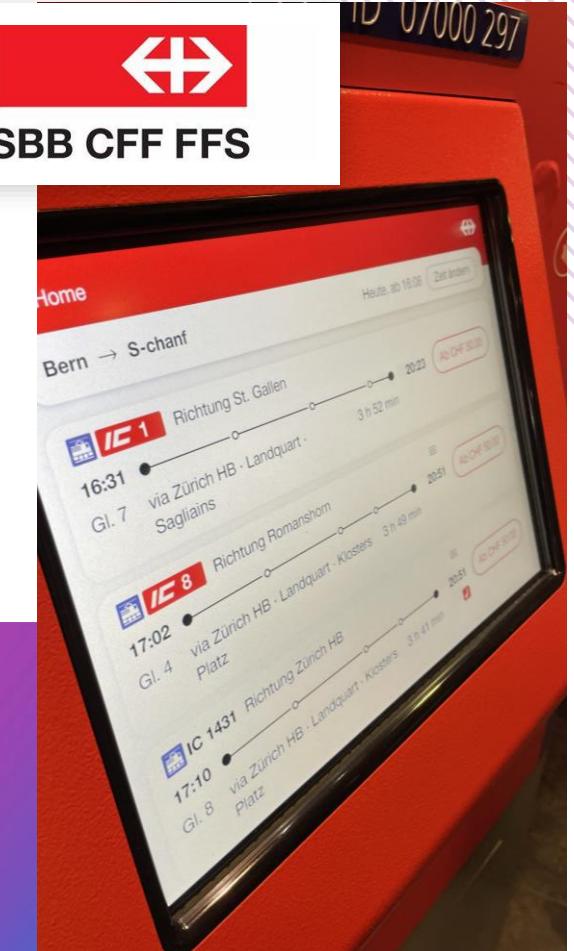
Intuitive
Barrier free

Diverse challenges



Creating the ticket vending machine of the future with Zühlke

Zühlke helps SBB with the development of its new ticket vending machine. The simple, user-friendly interface enables travellers to find the right ticket more quickly.



The Challenge

The hardware used in SBB's ticket vending machines has become obsolete and needs to be replaced. The user interface will also receive a complete makeover for the first time in 20 years and will be updated to meet customers' new needs.

The Solution

What is most challenging here is the scope of the system landscape, the mix of stakeholders and the more complex range of products and fares. Zühlke supports SBB in moving forward methodically and developing the software for its ticket vending machines.

The Results

The user interface is completely redeveloped for the new ticket vending machine model. Streamlining the user navigation makes it easier for travellers to purchase tickets and ultimately improves customer satisfaction. The development of the new ticket vending machine is also a major step towards paperless SBB ticketing in the future.

HoloLinc® – faster delivery and a great customer experience

TK Elevator devised a digitalised sales process to improve efficiency and the customer experience. Zühlke implemented the project in record time.



The Challenge

- HMI 2017 saw Microsoft and TK Elevator unveil a proof of concept for a HoloLens-based sales process.
- Zühlke's task was to implement the solution in a joint team with the client across multiple locations. By using agile methodologies the team achieved a spectacularly rapid time to market.

The Solution

- As a pioneer of digitalisation, TK Elevator wanted to rapidly revamp its stair lift sales process. With a tight deadline and budget, this was a major challenge – some of the basic technologies needed for the solution, such as displaying mixed reality on an iPad, were yet to be developed.
- There was also the issue of connectivity between the various devices and systems (iPad, HoloLens, Azure cloud and TK Elevator ERP system) via a variety of interfaces. The solution also needed to have an intuitive, easy to-use user interface.

The Results

- Zühlke's solution combined the iPad and HoloLens. With expertise from innumerable end-to-end IoT projects, Zühlke was able to deliver connectivity and backend solutions rapidly and simply.
- Thanks to Zühlke's distributed and agile development experience, HoloLinc® was ready to deploy in just 10 months.



Governance

Security
Privacy

Zühlke Security Development Lifecycle

Secure Configuration

Secure Automation

Monitoring and Logging/SIEM
SOAR/Anomaly Detection

Incident response

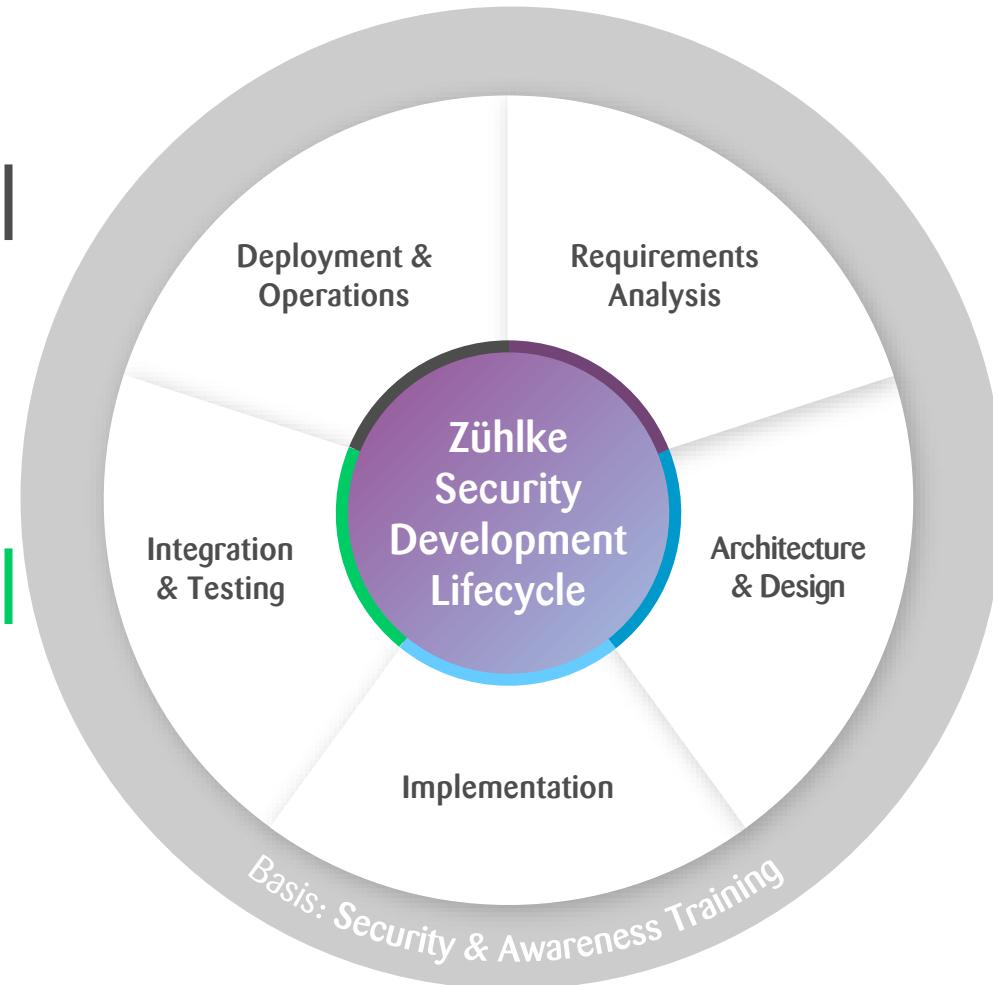
Disaster recovery

Dynamic Analysis/DAST

Fuzz Testing

Penetration Testing

05 |



01 |

Asset Inventory

Attacker Model

Threat Modelling/STRIDE

Metrics, Standards (e.g., IEC 62443),
Compliance (e.g., GDPR)

02 |

Security Principles

Identity Access Management/ PKI/Access Control

Cryptography

Security Reviews

Verification

Documentation

03 |

Secure Coding

Static Analysis/SAST

Software Component Analysis

Hardening

Third-party/Open Source Software

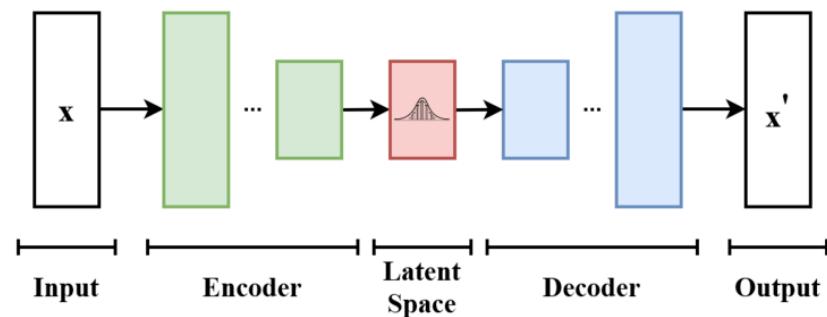
Patch management

Examples of our data processing expertise

Staying at the pulse of world-leading research

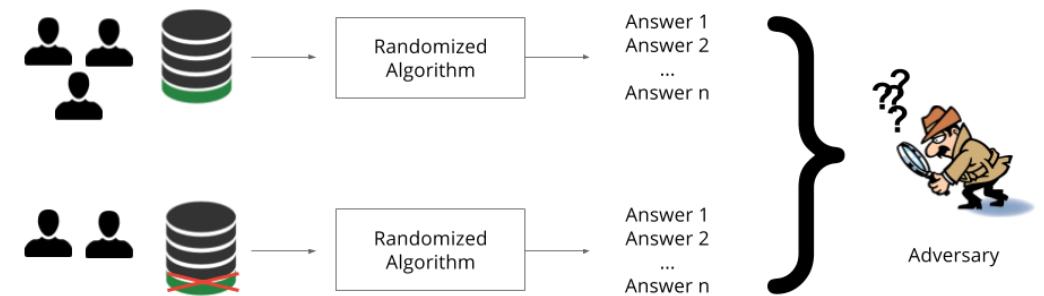
Variational Autoencoder: Synthetic data generation

- Research project at ETH Zürich
- Compressing input by training neural networks to reduce unnecessary information in Latent Space
- Sampling artificial data by decoding randomly generated points in Latent Space



Differential Privacy: Noising privacy-sensitive data

- Academic gold-standard for privacy-preserving data processing
- Mathematical guarantees for removal of sensitive information
- Explicitly recommended by GDPR



Preventing 1 million infections with the NHS COVID-19 app

Zühlke designed and developed UK's COVID-19 app and supporting infrastructure in just 12 weeks.



The Challenge

- As the world entered the COVID-19 lockdown, pressure mounted to accelerate MedTech innovation and find a way to reduce the rate of infection and protect lives. In these challenging conditions, the DHSC and its executive agency, UKHSA (previously PHE), urgently needed to help contain the spread of the virus, prevent infection, and alleviate pressure on the NHS with a medically-approved contact tracing smartphone app. The test and trace solution needed to be designed, built, tested, approved, and launched within 12 weeks. Plus, it had to support six critical features.

The Solution

- Together with the DHSC, we established a multi-disciplinary working group, which included policymakers, researchers, designers, engineers, as well as experts in security, ethics, accessibility.
- Despite the challenging conditions, we designed, developed, user tested, and launched the beta app in just six weeks. The app included all six mandated features and Class 1 'medical device' classification from the Medicines and Healthcare Products Regulatory Agency (MHRA).

The Results

- Together with the DHSC and our ecosystem partners, we designed and delivered a medically-approved mobile app with scalable supporting infrastructure in record time.
- The app was downloaded by more than 22 million people and analysis from the leading science journal, Nature, estimated that the COVID-19 app helped prevent 1 million infections during its first year. This equates to preventing 44,000 hospitalisations and almost 10,000 deaths.

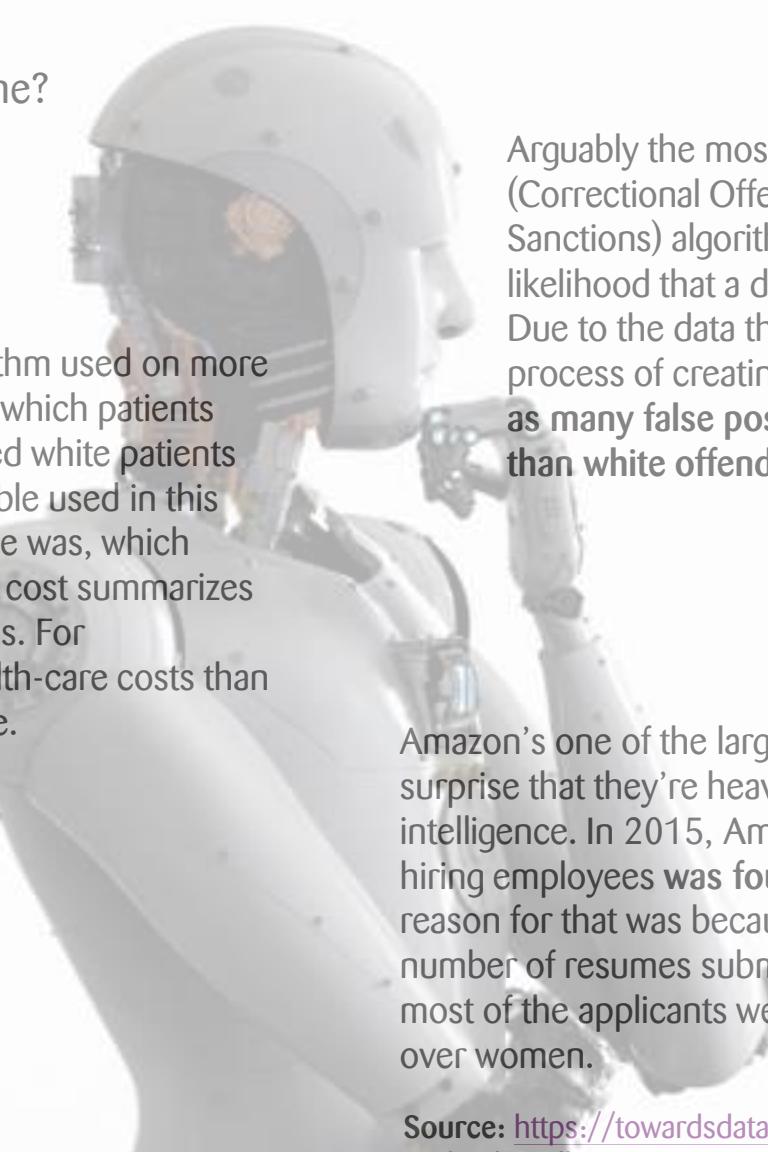


Social

Responsible AI Transparency

Algorithmic bias

Does your algorithm treat all people the same?



In October 2019, researchers found that an algorithm used on more than **200 million people** in US hospitals to predict which patients would likely need extra medical care heavily favored white patients over black patients. While race itself wasn't a variable used in this algorithm, another variable highly correlated to race was, which was healthcare cost history. The rationale was that cost summarizes how many healthcare needs a particular person has. For various reasons, black patients incurred lower health-care costs than white patients with the same conditions on average.

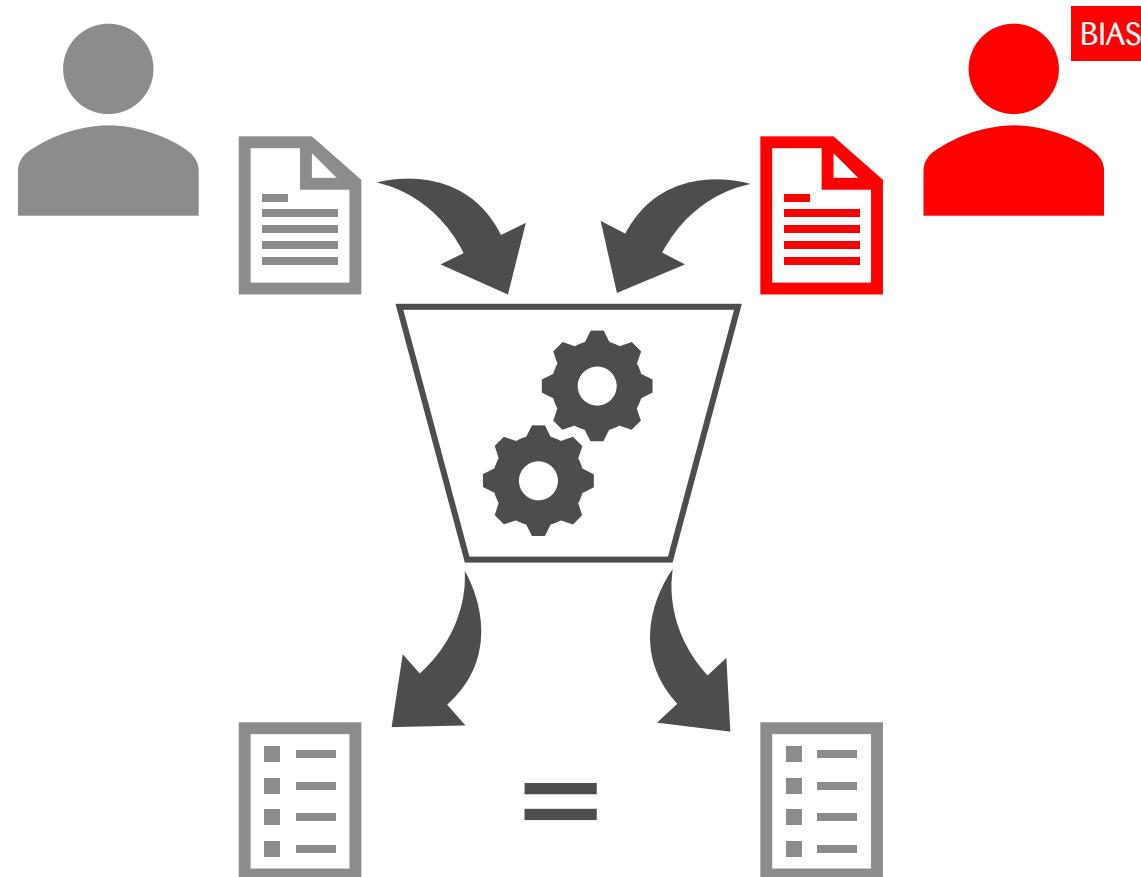
Arguably the most notable example of AI bias is the COMPAS (Correctional Offender Management Profiling for Alternative Sanctions) algorithm used in US court systems to predict the likelihood that a defendant would become a **recidivist**. Due to the data that was used, the model that was chosen, and the process of creating the algorithm overall, the model **predicted twice as many false positives for recidivism for black offenders (45%) than white offenders (23%)**.

Amazon's one of the largest tech giants in the world. And so, it's no surprise that they're heavy users of machine learning and artificial intelligence. In 2015, Amazon realized that their algorithm used for hiring employees **was found to be biased against women**. The reason for that was because the algorithm was based on the number of resumes submitted over the past ten years, and since most of the applicants were men, it was trained to favor men over women.

Source: <https://towardsdatascience.com/real-life-examples-of-discriminating-artificial-intelligence-cae395a90070>

Integrated bias-testing

Biased and un-biased personas must generate the same results



AI-Based Diagnostics Application

When AI is used for diagnosis – it has to be medical compliant and transparent making software development very complex. Zühlke delivered the solution in six months.



The Challenge

An international pharma company wanted to provide physicians with a diagnostics application based on Artificial Intelligence (AI) that supports the differential diagnosis of specific diseases. However, as the recommendations of this software are affecting the treatment of patients, it has to be implemented in a regulatory compliant way. With AI – this is a demanding interdisciplinary task.

The Solution

The Zühlke team consisting of experts for machine learning, data engineering, software development as well as regulatory experts performed the operationalization of the existing AI research prototype. In six months, Zühlke transformed the AI prototype – a model based on machine learning – into an application that is market ready and regulatory compliant.

The Results

In order to create the diagnostics software safe, sustainable and in a regulatory compliant way, Zühlke successfully applied its own process for the development of AI-based medical solutions. The result is an application that provides physicians not only with a diagnosis of the disease but can also explain, which factors were important for this prediction which creates trust and transparency.

Sustainable Software is

- efficient
- reliable
- inclusive &
- has a conscience